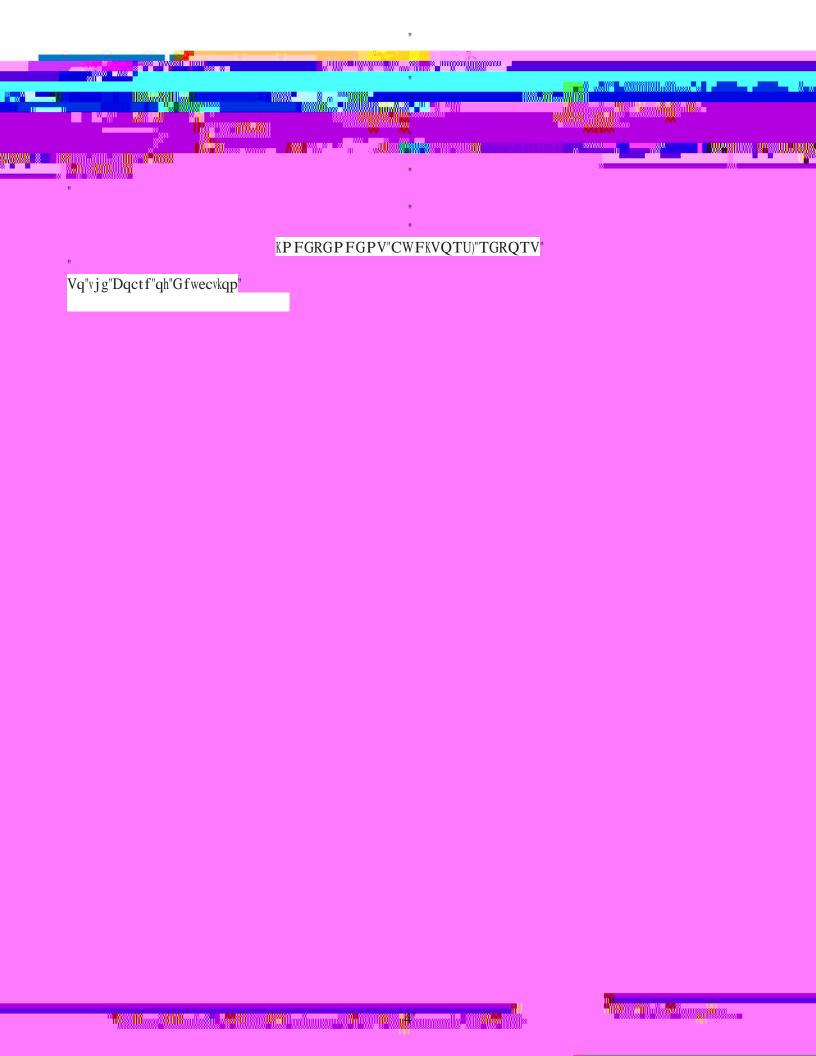
# ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" VCDNG"QH"EQPVGPVU" HQT"V J G"HKUECN" [ GCT"GPFGF"LWPG"52."4242"

# ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" VCDNG"QH"EQPVGPVU"\*EQPV\(\hbar)" HQT"V J G"HKUECN" [ GCT"GPFGF"LWPG"52."4242"

## ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" UE J QQN"DQCTF"QHHKEKCNU" HQT"V J G"HKUECN" [ GCT"GP FGF"LWPG"52."4242"

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Vtgcuwtgt"	Ftgy"O0"Tqvvigp"	291231423; "6"2815214242"



Y g" dgnkgxg" vjcv" vjg" cwfkv" gxkfgpeg" yg" jcxg" qdvckpgf" ku" uwhhkekgpv" cpf" crrtqrtkcvg" vq" rtqxkfg" c" dcuku" hqt" qwt" cwfkv" qrkpkqpu0"

#### Opinions"

 $\label{lem:condition} \begin{tabular}{ll} Kp" qwt" qrkpkqp." vjg" hkpcpekcn" uvcvg o gpvu" tghgttgf" vq" cdqxg" rtgugpv" hcktn{." kp" cm" o cvgtkcn" tgurgevu." vjg" tgurgevkxg" hkpcpekcn" rqukvkqp" qh" vjg" i qxgtp o gpvcn" cevkxkvkgu" cpf" gcej" o clqt" hwpf" qh" vjg" Ecdgnn" Eqwpv{" Dqctf"qh"Gfwecvkqp."cu"qh"Lwpg"52."4242."cpf"vjg" tgurgevkxg"ejcpigu"kp"hkpcpekcn" rqukvkqp"hqt"vjg" {gct"vjgp" gpfgf"kp"ceeqtfcpeg" ykvj" ceeqwpvkpi" rtkpekrngu" i gpgtcnn{"ceegrvgf"kp"vjg"Wpkvgf"Uvcvgu"qh"C o gtkec0" } \end{tabular}$ 

#### **Other Matters**

#### Required Supplementary Information

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#### ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" OCPCIGOGPVøU"FKUEWUUKQP"CPF"CPCN [ UKU" HQT"VJG"HKUECN" [ GCT"GPFGF"LWPG"52."4242"

 $Qwt"\ fkuewuukqp"\ cp\ f"\ cp\ cn\ \{\ uku''\ qh''\ v\ j\ g''\ Ecdgnn''\ Eqwpv\ \{\ ''\ Dqct\ f''\ qh''\ G\ fwec\ properties of the constraints of$ 

#### ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" OCPCIGOGPVøU"FKUEWUUKQP"CPF"CPCN [ UKU"

### ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" OCPCIGOGPVøU"FKUEWUUKQP"CPF"CPCN [ UKU" HQT"V J G"HKUECN" [ GCT"GPFGF"LWPG"52."4242"

 $\label{eq:cusing_state} Vjg"\,mg\{"\,gng\,o\,gpvu"\,qh"\,vj\,g"\,kpetgcug"\,qh"\,vj\,g"\,Dqctf\phiu"\,pgv"\,rqukvkqp"\,hqt"\,vj\,g"\,\{gct"\,gpfg\,f"\,Lwpg"\,52."\,4242."\,ctg"\,cu"\,hqnnq\,y\,u<"}$ 

Ewttgpv" cpf" qvjgt" cuugvu" kpetgcugf" d{"crrtqzkocvgn{"&643"vjqwucpf." yjkej" rtkoctkn{"tgrtgugpvu" kpetgcugf" rtqrgtv{"vczgu" tgegkxcdng."kpetgcugf" fgdv" ugtxkeg" eqnngevkqpu."cpf" cp" qxgtcnn" kpetgcug" kp" ecuj "dcncpegu0"

Ecrkvcn" Cuugvu"kpetgcugf"d{"crrtqzkocvgn{"&3205" oknnkqp." y jkej"rtkoctkn{"tgrtgugpvu"cp"kpetgcug" fwg"vq"vjg"eqpuvtwevkqp"qh" oclqt"ecrkvcn"rtqlgevu."kpenwfkpi"c"pgy"Jkijncyp"Gngogpvct{0"

 $Ewttgpv" \ cpf" \ qvjgt" \ nkcdknkvkgu" \ kpetgcugf" \ d\{"crrtqzkocvgn\{"\&308" \ oknnkqp." \ yjkej" \ ycu" \ rtkoctkn\{"vjg" \ tguwnv"qh"ucnctkgu."tgncvgf" \ rc\{tqnn"nkcdknkvkgu."cpf"ceeqwpvu" \ rc\{cdng0" \ nkcdknkvkgu."cpf"ceeqwpvu" \ rc\{cdng0" \ nkcdknkvkgu."cpf"ceeqwpvu" \$ 

 $Nqpi/vgto"nkcdknkvkgu"fgetgcugf"d{"\&902"oknnkqp."yjkej"ycu"rtkoctkn{"vjg"tguwnv"qh"cppwcn"fgdv"ugtxkeg0"}$ 

 $Fghgttgf"kphnqyu"qh"tguqwtegu"kpetgcugf"d{"crrtqzkocvgn{"\&503"oknnkqp."yjkej"ycu"rtkoctkn{"vjg"tguwnv"qh"ejcpigu"kp"vjg"Dqctføu"rtqrqtvkqpcvg"ujctg"qh"vjg"QRGD"nkcdknkv{0"}}$ 

 $Cv" \ vjg" \ gpf" \ qh" \ vjg" \ ewttgpv" \ hkuecn" \ \{gct." \ vjg" \ Dqctf" \ ku" \ cdng" \ vq" \ tgrqtv" \ rqukvkxg" \ dcncpegu" \ kp" \ cnn" \ vjtgg" \ ecvgiqtkgu" \ qh" pgv" \ rqukvkqp0"" Vjg" uc og "ukvwcvkqp" jgnf" vtwg" hqt" vjg" rtkqt" hkuecn" \ \{gct0" \ cnn" \ vjtgg" \ cnn" \ cn$ 

 $Tguvtkevgf"pgv"rqukvkqp"fgetgcugf"d{"crrtqzkocvgn{"\&604"oknnkqp"fwtkpi"vjg"{gct"gpfgf"Lwpg"52."}} \\ 42420""Vjku"fgetgcug"tguwnvgf"rtkoctkn{"htqo"vjg"wug"qh"tguvtkevgf"ecrkvcn"rtqlgev"hwpfu0"} \\ Tguvtkevgf"pgv"rqukvkqp"fgetgcug"tguwnvgf"rtkoctkn{"htqo"vjg"wug"qh"tguvtkevgf"ecrkvcn"rtqlgev"hwpfu0"} \\ Tguvtkevgf"pgv"rqukvkqp"fgetgcugf"d{"crrtqzkocvgn{"kgnungf"rtkocknownedgetgcug"tguvtkevgf"ecrkvcn"rtqlgev"hwpfu0"} \\ Tguvtkevgf"pgv"rqukvkqp"fgetgcugf"d{"crrtqzkocvgn{"kgnungf"rtkocknownedgetgcugf"tguvtkevgf"ecrkvcn"rtqlgev"hwpfu0"} \\ Tguvtkevgf"pgv"rqukvkqp"fgetgcugf"d{"crrtqzkocvgn{"kgnungf"rtkocknownedgetgcugf"tguvtkevgf"ecrkvcn"rtqlgev"hwpfu0"} \\ Tguvtkevgf"pgv"rqukvkqp"fgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevgf"tguvtkevgf"pgv"rtkocknownedgetgcugf"tguvtkevg$ 

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 $ECDGNN"EQWPV\ [\ "DQCTF"QH"GFWECVKQP"$ 

## ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" OCPC I GOGPVøU"FKUEWUUKQP"CPF"CPCN [ UKU" HQT"V J G"HKUECN" [ GCT"GPFGF"LWPG"52."4242"

#### $Hkpcpekcn"Cpcn\{uku"qh"vjg"Dqctf\emptyset u"Hwpfu"$

 $Cu"\ pqvg\ f"\ gctnkgt."\ vj\ g"\ Ue\ j\ qqn"\ Dqct\ f"\ wugu"\ hwp\ f"\ ceeqwpvkp\ i"\ vq"\ gpuwtg"\ cp\ f''\ fg\ o\ qpuvtcvg''\ eq\ o\ rnkcpeg''\ ykv\ j''$  hkpcpeg/tgncvg\ f"ng\ i\ cn"tgswktg\ o\ gpvu0''

### ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" OCPC I GOGPVøU"FKUEWUUKQP"CPF"CPCN [ UKU" HQT"V J G"HKUECN" [ GCT"GPFGF"LWPG"52."4242"

 $\label{lem:cffkvkqp.} \begin{tabular}{ll} Kp" cffkvkqp." vjg" hqnnqykpi" qvjgt" ejcpigu" kp" hwpf" dcncpegu" ujqwnf" dg" pqvgf" cpf" yjgvjgt" tguvtkevkqpu." eqookvogpvu."qt"qvjgt"nkokvcvkqpu"ukipkhkecpvn{"chhgev"vjg"cxckncdknkv{"qh"hwpf"tguqwtegu"hqt"hwvwtg"wug<"} \end{tabular}$ 

Vjg" I gpgtcn" Ewttgpv" Gzrgpug" Hwpf" ujqygf" cp" kpetgcug" kp" hwpf" dcncpeg=" jqygxgt." kv" ycu" okpk ok | gf"d{"vtcpuhgtu/qwv"hqt"ecrkvcn"rtqlgevu"

 $\label{thm:continuous} Vjg"Urgekcn"Tgxgpwg"Hwpf"ujqygf"cp"kpetgcug"kp"hwpf"dcncpeg"oquvn{"fwg"vq"vjg"eqnngevkqp"qh"tgxgpwg"tgrqtvgf"cu"fghgttgf"kphnqyu"qh"tguqwtegu"kp"vjg"rtkqt"{gct0}"$ 

 $\label{thm:continuous} Vjg"\ Urgeken"\ Tgxgpwg"\ o''\ Hgfgten"\ Uvk\ o\ wnwu"\ cpf''\ Uvcdknk\ |\ cvkqp''\ Hwpf''\ ujqygf''\ c''\ fgetgeug''\ kp''\ hwpf''\ denceg''fwg"vq''fgnc\{u''kp''tgegkxkpi''hgfgten''tgk\ o\ dwtug\ o\ gpvu''htq\ o\ ''vjg''Uvcvg''qh''\ Yguv''Xktikpke0''$ 

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 $\label{lem:condition} Vjg"\,Dqctf"\,jcf"\,ukz"\,o\,clqt"\,hwp\,fu"\,hqt"\,vj\,g"\,hkuecn"\,\{gct"\,gp\,fg\,f"\,Lwpg"\,52."\,42420"\,"\,Vj\,qug"\,hwp\,fu"\,ctg"\,vj\,g"\,\,I\,gpgtcn"\,\,Ewttgpv"\,Gz\,rgpug"\,Hwp\,f."\,Ur\,gekcn"\,Tgxgpwg"\,6"\,Hg\,fgtcn"\,\,Uvk\,o\,wnwu"\,cp\,f"\,\,Uvcdknk\,|\,cvkqp"\,\,Hwp\,f."\,Fgdv"\,Ugtxkeg"\,Hwp\,f.\,"Rgt\,o\,cpgpv"\,K\,o\,r\,tqxg\,o\,gpv"\,Hwp\,f.\,"cp\,f"\,Ec\,rkvcn\,"\,Rt\,ql\,gevu\,"\,Hwp\,f."$ 

#### General Current Expense Fund

Vjku" ku" vjg" rtkpekrcn" qrgtcvkqp" hwpf" yjkej" ceeqwpvu" hqt" cm" hkpcpekcn" tguqwtegu" qh" vjg" Dqctf" gzegrv" vjqug"tgswktgf"vq"dg"ceeqwpvgf"hqt"kp"cpqvjgt"hwpf0""Vjg"hwpf"dcncpeg"kpetgcugf"htqo"&560: "oknnkqp"vq" &5903" oknnkqp" fwtkpi" vjg" hkuecn" {gct" gpfgf" Lwpg" 52." 42420" Vjku" kpetgcug" qh" &405" oknnkqp" ycu" fwg" rtkoctkn{"vq"cp"kpetgcug"kp"tgxgpwg"htqo"rtqrgtv{"vczgu"cpf"uvcvg"uqwtegu0"

#### Special Revenue Fund

Vjku"ku"cp"qrgtcvkpi"hwpf"qh"vjg"Dqctf"cpf"ceeqwpvu"hqt"cnn"tgxgpwgu"cpf"gzrgpfkvwtgu"cvvtkdwvcdng"vq" uvcvg" cpf" hgfgtcn" itcpvu" cpf" qvjgt" tgxgpwg" uqwtegu" vjcv" ctg" ngicnn{" tguvtkevgf" vq" gzrgpfkvwtgu" hqt" urgekhke"rwtrqugu0""Vjg"hwpf"dcncpeg"kpetgcugf"htqo"&:64"vjqwucpf"vq"&50;" o knnkqp" fwtkpi"vjg"hkuecn" {gct" gpfgf"Lwpg" 52." 42420" "Vjku" kpetgcug" qh" &503" o knnkqp" y cu" fwg" rtk o ctkn{" vq" vjg" eqnngevkqp" qh" tgxgpwg"tgrqtvgf"cu"fghgttgf"kphnqyu"qh"tguqwtegu"kp"vjg"rtkqt"{gct0"

#### Special Revenue – Federal Stimulus and Stabilization Fund

 $\label{thm:constraint} Vjku" ku" cp" qrgtcvkpi" qh" vjg" Dqctf" cpf" ceeqwpvu" hqt" cnn" tgxgpwgu" cpf" gzrgpfkvwtgu" cvvtkdwvcdng" vq" hgfgtcn" uvk o wnwu" hwpfu0" Vjg" hwpf" dcncpeg" y cu" qrgpgf" fwtkpi" vjg" urtkpi" qh" 4242" kp" tgurqpug" vq" vjg" EQXKF/3; "rcpfg o ke0" Vjg" hwpf" dcncpegu" fgetgcugf" htq o "&2" vq" &*453" vjqwucpf+" fwtkpi" vjg" hkuecn" {gct" gpfgf" Lwpg" 52." 42420" Vjku" fgetgcug" qh" &453" vjqwucpf" y cu" fwg" rtk o ctkn {"vq" fgnc {u"kp" tgegkxkpi" hgfgtcn" tgk o dwtug o gpvu" htq o "vjg" Uvcvg" qh" Y guv" Xktikpkc0" }$ 

#### ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP UVCVGOGPV"QH"PGV"RQUKVKQP LWPG"52."4242

I qxgtp o gpvcn" Cevkxkvkgu

CUUGVU Ecuj "cpf"ecuj "gswkxcngpvu Kpxguv o gpvu

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#### ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP UVCVGOGPV"QH"CEVKXKVKGU HQT"V J G"HKUECN" [ GCT"GPFGF"LWPG"52."4242

			Rtqitco"Tgxgpwgu		Pgv"*Gzrgpug+.
			Qrgtcvkpi	Ecrkven	Tgxgpwg" ("Ejcpigu
**		Ejctigu"hqt	I tepvu"epf	I tepvu"epf	kp"Pgv"Rqukvkqp
Hwpevkqpu	Gzrgpugu	Ugtxkegu	Eqpvtkdwvkqpu	Eqpvtkdwvkqpu	I qxgtp o gpvcn"Cevkxkvkgu
I qxgtp o gpvcn"cevkxkvkgu<					
Kpuvtwevkqp	&"""":::.552.553	&""""#45;.666	&"""";.:56.3;6	&""""5.3;4.229	&"""*97.286.8:8+
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Uvwfgpvu	""";.484.;;9	""""""""""""""""""""""""""""""""""""""	"""""3.593.96:	""""543.95:	""""*9.78;.733+
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Qrgtcvkqp"cpf" o ckpvgpcpeg"qh"hceknkvkgu	37.886.895	**************************************	""""4.53;.989	766.2;4	""""*34.:22.:36+
Uvwfgpv"vtcpurqtvcvkqp	,.752.538	y	3.633.557	""""553.245	""""*9.9:9.;7:+
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Eqoowpkv{"ugtxkegu	""""4.438.58;	y	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	y	*4.438.58;+
Kpvgtguv"qp"nqpi/vgto"fgdv	""""*5;:8+	**************************************	y	y	**************************************
Vqvcn" i qxgtp o gpvcn"cevkxkvkgu	&""""376.876.398	&""""45;.666	&""""49.337.:96	&"""""6.;;5.942	344.527.35:+
	I gpgtcn"tgxgpwgu<				
	Rtqrgtv{"vczgu				77.7;3.726
	Wptguvtkevgf"uvcvg	"ckf			:2.:6;.2:6
	Wptguvtkevgf"kpxgi				3.97:.529
		vu"cpf"eqpvtkdwvkqpu			3.228.:47
		kurqukvkqp"qh"ecrkvcn"cuu	1 <b>0</b> V11		*335.:22+
	Vtcpuhgtu"kp	ar quaraqp qu ceraren euc	.51u		"""; .7:2.49;
	Vtcpuhgtu"*qwv+				;.7:2.49;+
	Vqvcn" i gpgtcn"tgxgpwg	u"en f"vtenuhatu			35;.2;3.;42
	Ejcpig"kp"pgv"rqukvkqt				33,.2,3.,42
	Pgv"rqukvkqp"/"dgikppk				438.:36.389
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	r gv r quxvxqp / gprxpr				α 433.022.,0,

#### ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP DCNCPEG"U J GGV"/" I QXGTP OGPVCN"HWP FU LWPG"52."4242

${\bf CUUGVU"CPF"FGHGTTGF"QWVHNQ~Y~U"QH"TGUQWTEGU}$	I gpgtcn Ewttgpv Gzrgpug Hwpf	Urgeken" Tgxgpwg Hwpf	Hgfgtcn"Uvk o wnwu cpf"Uvcdknk   cvkqp Hwpf	Fgdv Ugtxkeg Hwpf	Rgtocpgpv Kortqxgogpv Hwpf	Ecrkven Rtqlgevu Hwpf	Vqvcn" I qxgtp o gpvcn Hwp fu
Cuugvu<							
Ecuj"cpf"ecuj"gswkxcngpvu	&"""""66.782.757	&""""5.444.529	&""""""""""""""""""""""""""""""""""""""	&""""45	&""""7.959.9;5	&""""33.68:.945	&""""86.;:;.5:3
Крхдич о друи	y	<i>y</i>	y	"""""""5.284.:6:	y	у	""""""""""""""""""""""""""""""""""""""
Vczgu"tgegkxcdng."pgv	***************************************	y	y	""""87:.99;	""""34;.363	y	"""""7.26;.957
Fgrqukv" y kvj "tgvktg o gpv"dqctf	***************************************	y	y	y	y	y	""""439.762
Rtgrckf" y qtmgtu)"eq o r	"""""3;9.:69	<i>y</i>	y	<i>y</i>	y	y	"""""""3;9.:69
Qvjgt"rtgrckf"gzrgpug	***************************************	y	<i>y</i>	<i>y</i>	y	y	""""""376.;59
Hqqf"ugtxkeg"tgegkxcdng."pgv		953.962	<i>y</i>	<i>y</i>	y	y	""""""953.962
Qvjgt"tgegkxcdngu	33.797	y	<i>y</i>	y	y	y	""""""33.797
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# ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP TGEQPEKNKCVKQP"QH"V J G"DCNCPEG"U J GGV"/" I QXGTP OGPVCN"HWP FU" VQ"V J G"UVCVGOGPV"QH"PGV"RQUKVKQP LWPG"52."4242

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$\label{lem:constraint} Ecrkvcn" cuugvu" wugf"kp" i qxgtp o gpvcn" cevkxkvkgu" ctg"pqv"hkpcpekcn" tguqwtegu" cpf." vjgtghqtg." ctg"pqv" tgrqtvgf" kp" vjg" hwpf" dcncpeg" ujggv$	"""""3:9.;67.466
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# ECDGNN"EQWPV["DQCTF"QH"GFWECVKQP TGEQPEKNKCVKQP"QH"VJG"UVCVGOGPV"QH"TGXGPWGU."GZRGPFKVWTGU."CPF"EJCPIGU" KP"HWPF"DCNCPEGU"/"IQXGTPOGPVCN"HWPFU"VQ"VJG"UVCVGOGPV"QH"CEVKXKVKGU HQT"VJG"HKUECN"[GCT"GPFGF"LWPG"52."4242

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# ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP UVCVGOGPV"QH"HKFWEKCT [ "PGV"RQUKVKQP"/"HKFWEKCT [ "HWPFU LWPG"52."4242

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#### Pqvg"3"/"Uw o oct { "qh"Uk i pkhkecpv"Ceeqwpvkp i "Rqnkekgu<"

 $\label{eq:condition} Vjg" ceeq o rcp\{kpi" hkpcpekcn" uvcvg o gpvu" jcxg" dggp" rtgrctgf" kp" eqphqt o kv\{" ykvj" ceeqwpvkpi" rtkpekrngu" i gpgtcnn\{" ceegrvgf" kp" vjg" Wpkvgf" Uvcvgu" qh" C o gtkec" * I CCR+" cu" crrnkgf" vq" nqecn" i qxgtp o gpv" wpkvu0" Vjg" I qxgtp o gpvcn" Ceeqwpvkpi "Uvcpfctfu" Dqctf" * I CUD+"ku" vjg" ceegrvgf" uvcpfctf/ugvvkpi "dqf{"hqt" guvcdnkujkpi" i qxgtp o gpvcn" ceeqwpvkpi "cpf" hkpcpekcn" tgrqtvkpi "rtkpekrngu0"""$ 

#### C0" Tgrqtvkpi "Gpvkv {<"

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#### D0" Fkuvtkev/ykfg"cpf"Hwpf"Hkpcpekcn"Uvcvgogpvu<"

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 $\label{thm:continuous} Vjg" \textit{fund financial statements}" \texttt{rtqxkfg}" \texttt{kphqt} o \texttt{cvkqp}" \texttt{cdqwv}" \texttt{vjg}" \texttt{kpfkxkfwcn}" \texttt{hwpfu}" o \texttt{ckpvckpgf}" \texttt{d} \{ \texttt{"vjg}" \texttt{Uejqqn}" \texttt{Dqctf0}" \texttt{Cnn}" \texttt{hwpfu}" o \texttt{ckpvckpgf}" \texttt{d} \{ \texttt{"vjg}" \texttt{uejqqn}" \texttt{fkuvtkev}" \texttt{ctg}" \texttt{eqpukfgtgf}" \texttt{vq}" \texttt{dg}" o \texttt{clqt}" \texttt{hwpfu}" \texttt{hqt}" \texttt{tgrqtvkpi}" \texttt{rwtrqugu}" \texttt{cpf}" \texttt{ctg}" \texttt{fkuetgvgn} \{ \texttt{"rtgugpvgf}" \texttt{kp'vjg}" \texttt{ceeq} o \texttt{rcp} \{ \texttt{kpi} "\texttt{hkpcpekcn}" \texttt{uvcvg} o \texttt{gpvu0}" \texttt{""}" \}$ 

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 $\label{thm:power} \begin{aligned} &\text{Dqct}\,f^{\text{"}}\,\text{uf}^{\text{"}}\,\text{g}\,\text{fwecvkqp}^{\text{"}}\,\text{ctg}^{\text{"}}\,\text{cwv}\,j\,\text{gt}^{\text{"}}\,\text{l}\,\text{g}^{\text{"}}\,\text{d}\,\text{"uvcvwvg}^{\text{"}}\,\text{vq}^{\text{"}}\,\text{rtqxk}\,f\,\text{g}^{\text{"}}\,\text{gzeguu}^{\text{"}}\,\text{hwp}\,f\,\text{u}^{\text{"}}\,\text{vj}\,\text{g}^{\text{"}}\,\text{Vi}\,\text{g}^{\text{"}}\,\text{Uvcvg}^{\text{"}}\,\text{Eqpuqnk}\,f\,\text{cvg}\,f^{\text{"}}\,\text{Kpxguv}\,\text{o}\,\text{gpv}^{\text{"}}\,\text{Rqqn}^{\text{"}}\,\text{qt}^{\text{"}}\,\text{vj}\,\text{g}^{\text{"}}\,\text{Owpkekrcn}^{\text{"}}\,\text{Dqp}\,f^{\text{"}}\,\text{Eq}\,\text{o}\,\text{o}\,\text{kuukqp}^{\text{"}}\,\text{hqt}^{\text{"}}\,\text{kpxguv}\,\text{o}\,\text{gpv}^{\text{"}}\,\text{rvtrqugu}.^{\text{"}}\,\text{qt}^{\text{"}}\,\text{vq}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{uwe}\,j\,^{\text{"}}\,\text{hwp}\,f\,\text{u}^{\text{"}}\,\text{kp}^{\text{"}}\,\text{uvcvgu}^{\text{"}}\,\text{qt}^{\text{"}}\,\text{vg}\,\text{gruv}^{\text{"}}\,\text{kpxguv}\,\text{gruv}^{\text{"}}\,\text{uwe}\,j\,^{\text{"}}\,\text{hwp}\,f\,\text{u}^{\text{"}}\,\text{kp}^{\text{"}}\,\text{uvcvgu}^{\text{"}}\,\text{qt}^{\text{"}}\,\text{vg}\,\text{gruv}^{\text{"}}\,\text{kpxguv}\,\text{gruv}^{\text{"}}\,\text{kpxguv}\,\text{gruv}^{\text{"}}\,\text{kpxguv}\,\text{gruv}^{\text{"}}\,\text{kpxguv}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,\text{kpxguv}^{\text{"}}\,\text{gruv}^{\text{"}}\,$ 

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#### Pqvg"3"/"Uwooct{"qh"Ukipkhkecpv"Ceeqwpvkpi"Rqnkekgu"\*Eqpv0+<"

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 $Ecrkvcn"cuugvu."y\ jkej"kpenwfg"ncpf."dwknfkpiu"cpf"k\ o\ rtqxg\ o\ gpvu."hwtpkvwtg"cpf"gswkr\ o\ gpv."cpf"xgjkengu"ctg"tgrqtvgf"kp"vjg"fkuvtkev/ykfg"hkpcpekcn"uvcvg\ o\ gpvu0"Vjg"dqctf"fghkpgu"ecrkvcn"cuugvu"cu"cuugvu"ykvj"cp"kpkvkcn."kpfkxkfwcn"equv"qh"&7.222."qt"oqtg"hqt"ncpf."hwtpkvwtg."xgjkengu."cpf"gswkr\ o\ gpv"cpf"&322.222."hqt"dwknfkpiu"cpf"cp"guvk ocvgf"wughwn"nkhg"kp"gzeguu"qh"vyq"{gctu0"Rwtejcugf"qt"eqpuvtwevgf"ecrkvcn"cuugvu"ctg"tgrqtvgf"cv"equv"qt"guvk ocvgf"jkuvqtkecn"equv0"Fqpcvgf"ecrkvcn"cuugvu"ctg"tgeqtfgf"cv"guvk ocvgf"hckt"xcnwg"cv"vjg"fcvg"qh"fqpcvkqp0"Vjg"equv"qh"pqtocn"ockpvgpcpeg"cpf"tgrcktu"vjcv"fq"pqv"cff"vq"vjg"xcnwg"qh"vjg"cuugv"qt"ocvgtkcm{"gzvgpfgf"cuugvuø"nkxgu"ctg"pqv"ecrkvcnk|gf0"}$ 

 $Oclqt"\ qwvnc \{u"\ hqt"\ ec\ rkvcn"\ cuugvu"\ cp\ f"\ k\ o\ rtqxg\ o\ gpvu"\ ctg"\ ec\ rkvcnk\ |\ g\ f"\ cu"\ rtqlgevu"\ ctg"\ eqpuvtwevg\ f0"\ Kpvgtguv"\ kpewttg\ f"\ fwtkp\ i\ "v\ j\ g"\ eqpuvtwevkqp"\ r\ j\ cug"\ ku"\ pqv"\ ec\ rkvcnk\ |\ g\ f0"$ 

 $\label{lem:continuity} Dwknfkpiu"cpf"kortqxgogpvu."hwtpkvwtg"cpf"gswkrogpv."cpf"xgjkengu"qh"vjg"Dqctf"ctg"fgrtgekcvgf"wukpi"vjg"uvtckijv/nkpg"ogvjqf"qxgt"vjg"hqnnqykpi"guvkocvgf"wughwn"nkxgu<"$ 

Cuugvu	gctu [		
Dwkn fkpiu	72		
Ukvg"k ortqxg ogpvu	42/57		
Hwtpkvwtg"cpf"gswkrogpv	7/42		
Xgjkengu	:/34		

#### M0""Fghgttgf"Qwvhnqy"qh"Tguqwtegu<"

 $C"fghgttgf"qwvhnqy"qh"tguqwtegu"ku"c"eqpuw o rvkqp"qh"pgv"rqukvkqp"d\{"vjg"iqxgtpogpv"vjcv"ku"crrnkecdng"vq"c"hwvwtg"tgrqtvkpi"rgtkqf0"$ 

Fghgttgf"Qwvhnqyu"qh"Tguqwtegu"cu"qh"Lwpg"52."4242<"

 $Fghgttgf"qwhqyu"qh"tguqwtegu"tgncvgf"vq"rgpukqpu & """""4.53;.965 \\ Fghgttgf"qwhqyu"qh"tguqwtegu"tgncvgf"vq"QRGD & """""7.:9;.66:$ 

#### Pqvg"3"/"Uwooct{"qh"Ukipkhkecpv"Ceeqwpvkpi"Rqnkekgu"\*Eqpv0+<"

#### NO" Rgpukqpu<"

#### $O \emptyset " \underline{Eq\ o\ rgpucvg\ f\ "Cdugpegu"cp\ f\ "Qv\ j\ g\ t\ "Rquv"G\ o\ rnq\ \{\ o\ gpv\ "Dgpghkv"Nkcdknkv\ \{<\ "Cdugpegu"cp\ f\ "Qv\ j\ g\ t\ "Rquv\ "G\ o\ rnq\ \{\ o\ gpv\ "Dgpghkv"Nkcdknkv\ q\ |\ Cdugpegu\ "Cdugpegu"cp\ f\ "Qv\ j\ g\ t\ "Rquv\ "G\ o\ rnq\ q\ q\ pv\ "Dgpghkv"Nkcdknkv\ q\ |\ Cdugpegu\ "Cdugpegu"cp\ f\ "Qv\ j\ g\ t\ "Rquv\ "G\ o\ rnq\ q\ q\ pv\ "Dgpghkv"Nkcdknkv\ q\ |\ Cdugpegu\ "Cdugpegu"cp\ f\ "Qv\ j\ g\ t\ "Rquv\ "G\ o\ rnq\ q\ q\ pv\ "Dgpghkv"Nkcdknkv\ q\ |\ Cdugpegu\ "Cdugpegu\ "Cdugpegu"cp\ f\ "Cdugpegu\ "Cdugpegu"cp\ f\ "Cdugpegu\ "Cdugpegu"cp\ f\ "Cdugpegu\ f\ "Cdugpegu"cp\ f\ "Cdugpegu"cp\ f\ "Cdugpegu\ f\ "Cdugpegu"cp\$

#### $Eq\ o\ rgpucvg\ f"Cdugpegu<"$

 $\label{two_points} \begin{minipage}{0.5\textwidth} $Kv" ku" vjg" Uejqqn" Dqctføu" rqnke{" vq" rgt o kv" go rnq{ggu" vq" ceew o wncvg" gctpgf" dwv" wpwugf" xcecvkqp" rc{" dgpghkvu0""Xcecvkqp"dgpghkvu"ecp"dg"ceew o wncvgf"wr"vq"62"fc{u"cpf"ecttkgf"hqt y ctf"vq"vjg"uwdugs wgpv"hkuecn" {gct0"""Cnn" xcecvkqp" rc{" ku" ceetwgf" yjgp" kpewttgf" cpf" vjg" nkcdknkv{" hqt" vjgug" coqwpvu" ku" tgrqtvgf" kp" vjg" igpgtcn" nqpi/vgto" fgdv" ceeqwpv" i tqwr0"" Wrqp" vgt o kpcvkqp" go rnq{ggu" oc{" dg" eqo rgpucvgf" hqt" xcecvkqp" dgpghkvu"ceew o wncvgf0" Kp"nkgw"qh"c"ecuj" rc{ogpv"cv" tgvktgogpv."go rnq{ggu"jktgf" rtkqt"vq"Lwn{"3."4237"ecp" gngev" vq" wug" ceew o wncvgf" cppwcn" ngcxg" vqyctf" vjgkt" rquvgornq{ogpv"jgcnvj" ectg" kpuwtcpeg" rtgokwo0"" Go rnq{ggu"cnuq"gctp"ukem"ngcxg"dgpghkvu" yjkej"ceew o wncvg"dwv"fq"pqv"xguv0"""} \end{minipage}$ 

#### $Qvjgt"Rquv"G\ o\ rnq\{\ o\ gpv"Dgpghkv"*QRGD+"Nkcdknkv\{<^{"}\}$

#### Pqvg"3"/"Uwooct{"qh"Ukipkhkecpv"Ceeqwpvkpi"Rqnkekgu"\*Eqpv0+<"

#### P0" Nqpi/vgt o "Qdnki cvkqpu<"

Kp"vjg" fkuvtkev/ykfg"hkpcpekcn"uvcvg o gpvu."nqpi/vgt o "fgdv"cpf"qvjgt"nqpi/vgt o "qdnkicvkqpu"ctg"tgrqtvgf"cu"nkcdknkvkgu"kp"vjg"crrnkecdng"iqxgtp o gpvcn"cevkxkvkgu."uvcvg o gpv"qh"pgv"rqukvkqp0""Dqpf"rtg o kwou"cpf"fkueqwpvu"ctg"fghgttgf"cpf"coqtvk|gf"qxgt"vjg"nkhg"qh"vjg"dqpfu"wukpi"vjg"ghhgevkxg"kpvgtguv"ogvjqf0""Dqpfu"rc{cdng"ctg"tgrqtvgf"pgv"qh"vjg"crrnkecdng"dqpf"rtgokwo"qt"fkueqwpv0""Kuuwcpeg"equvu."yjgvjgt"qt"pqv"ykvjjgnf"htqo"vjg"cevwcn"fgdv"rtqeggfu"tgegkxgf."ctg"tgrqtvgf"cu"gzrgpugu"fwtkpi"vjg"rgtkqf"kp"yjkej"vjg"dqpfu"ygtg"kuuwgf0"""

 $\label{lem:continuous} \begin{tabular}{ll} Kp"vjg"hwpf"hkpcpekcn"uvcvg\ o\ gpvu."i\ qxgtp\ o\ gpvcn"hwpf"v\{\ rgu"tgeq\ i\ pk\ |\ g"dqpf"rtg\ o\ kw\ o\ u"cpf"fkueqwpvu"fwtkp\ i"vjg"ewttgpv"rgtkqf0""Vjg"hceg"c\ o\ qwpv"qh"fgdv"kuuwgf"ku"tgrqtvgf"cu"qvjgt"hkpcpekpi"uqwtegu0""Rtg\ o\ kw\ o\ u"tgegkxgf"qp"fgdv"kuuwcpegu"ctg"tgrqtvgf"cu"qvjgt"hkpcpekpi"uqwtegu"yjkng"fkueqwpvu"qp"fgdv"kuuwcpegu"ctg"tgrqtvgf"cu"qvjgt"hkpcpekpi"wugu0""Kuuwcpeg"equvu."yjgvjgt"qt"pqv"ykvjjgnf"htqo"vjg"cevwcn"fgdv"rtqeggfu"tgegkxgf."ctg"tgrqtvgf"cu"fgdv"ugtxkeg"gzrgpfkvwtgu0""Ecrkvcn"ngcug"rc{o\ gpvu"ctg"tgrqtvgf"kp"vjg"igpgtcn"ewttgpv"gzrgpug"qt"urgekcn"tgxgpwg"hwpf0"\\ \end{tabular}$ 

#### $Q0""\underline{Fghgttgf"Kphnqy"qh"Tguqwtegu<"}$

 $C"fghgttgf"kphnqy"qh"tguqwtegu"ku"cp"ceswkukvkqp"qh"pgv"rqukvkqp"d{"vjg"iqxgtpogpv"vjcv"ku"crrnkecdng"vq"c"hwvwtg"tgrqtvkpi"rgtkqf0""Vjg"Dqctføu"fghgttgf"kphnqyu"qh"vjg"hwpf"hkpcpekcn"uvcvgogpvu"kpenwfg"rtqrgtv{"vczgu."ejknf"pwvtkvkqp."cpf"qvjgt"tgegkxcdngu0""Fghgttgf"kphnqyu"hqt"vjg"iqxgtpogpv/ykfg"hkpcpekcn"uvcvgogpvu"kpenwfg"vjg"rtqrqtvkqpcvg"ujctg"qh"vjg"Dqctføu"pgv"fkhhgtgpeg"dgvyggp"rtqlgevgf"cpf"cevwcn"gctpkpiu"cpf"vjg"fkhhgtgpegu"dgvyggp"vjg"gornq{gt"eqpvtkdwvkqpu"cpf"rtqrqtvkqpcvg"ujctg"qh"eqpvtkdwvkqpu0"$ 

Fghgttgf"Kphnqyu"qh"Tguqwtegu"cu"qh"Lwpg"52."4242<"

#### Pqvg"3"/"Uwooct{"qh"Ukipkhkecpv"Ceeqwpvkpi"Rqnkekgu"\*Eqpv0+<"

#### R0"Pgv"Rqukvkqp<"

 $Pgv" \ rqukvkqp" \ ku" \ encuukhkg \ f" \ kpvq" \ hqwt" \ ecvg \ i \ qtkgu" \ ceeqt \ fkp \ i" \ vq" \ gzvgtpcn" \ fqpqt" \ tguvtkevkqpu" \ qt" \ cxckncdknkv \ \{" \ qh" \ cuugvu" \ hqt" \ ucvkuhcevkqp" \ qh" \ Dqct \ f" \ qdnk \ i \ cvkqpu0" \ V \ j \ g" \ Dqct \ føu" \ pgv" \ rqukvkqp" \ ku" \ encuukhkg \ f" \ cu" \ hqnnq \ y \ u<"$ 

Tguvtkevgf"pgv"rqukvkqp."gzrgpfcdng"/"Vjku"kpenwfgu"tguqwtegu"kp"yjkej"vjg"Dqctf"ku"ngicnn{"qt" eqpvtcevwcnn{"qdnkicvgf"vq"urgpf"kp"ceeqtfcpeg"ykvj"tguvtkevkqpu"korqugf"d{"gzvgtpcn"vjktf"rctvkgu" kpenwfkpi"itcpvqtu." qt"ncyu"qt"tgiwncvkqpu"qh"qvjgt"iqxgtpogpvu."qt"korqugf"d{"ncy"vjtqwij"eqpuvkvwvkqpcn"rtqxkukqpu"qt"gpcdnkpi"ngikuncvkqp0"

**Wptguvtkevgf"pgv"rqukvkqp"/**"Vjku"tgrtgugpvu"tguqwtegu"fgtkxgf"htqo"qvjgt"vjcp"ecrkvcn"cuugvu"qt"tguvtkevgf"pgv"rqukvkqp0"Vjgug"tguqwtegu"ctg"wugf"hqt"vtcpucevkqpu"tgncvkpi"vq"vjg"igpgtcn"qrgtcvkqp"qh"vjg"Dqctf."cpf"oc{"dg"wugf"cv"vjg"fkuetgvkqp"qh"vjg"Dqctf"vq"oggv"ewttgpv"gzrgpugu"hqt"cp{"ncyhwn"rwtrqug0"

#### $S0" \underline{Hwpf"Gswkv} < "$

 $\label{thm:continuous} Vjg" Dqctf" hqnnqyu" I CUD" Uvcvg o gpv" Pq0" 76" \~oHwpf" Dcncpeg" Tgrqtvkpi" cpf" I qxgtp o gpvcn" Hwpf" V \{ rg" Fghkpkvkqpu.\"o" y j kej" guvcdnku j gu" pg y "uvcpfctfu" qh" ceeqwpvkpi "cpf" hkpcpekcn" tgrqtvkpi "vjcv" ctg" kpvgpfgf" vq" k o rtqxg" v j g" enctkv { "cpf" eqpukuvgpe { "qh" v j g" hwpf" dcncpeg" kphqt o cvkqp" rtqxkfgf" vq" hkpcpekcn" tgrqtv" wugtu0" V j g" encuukhkecvkqpu" ctg" dcugf" rtk o ctkn { "qp" v j g" gzvgpv" vq" y j kej "v j g" Dqctf" ku" dqwpf" vq" j qpqt" eqpuvtckpvu" qp" v j g" urgekhke" rwtrqugu" hqt" y j kej "v j g" c o qwpvu" kp" v j qug" hwpfu" ecp" dg" urgpv0" Hwpf" dcncpegu" ctg" tgrqtvgf" kp" v j g" hqnnq y kpi "ecvgiqtkgu<"""$ 

 $\label{eq:pqpurgpfcdng} Pqpurgpfcdng" hwpf" dcncpegu" kpenwfg" coqwpvu" vjcv" ecppqv" dg" urgpv" dgecwug" vjg{" ctg" kp" c" pqpurgpfcdng" hqto." uwej" cu" kpxgpvqt{." qt" rtgrckf" gzrgpug" coqwpvu." qt" vjg{" ctg" ngicm{" qt" eqpvtcevwcnn{"tgswktgf"vq"dg" ockpvckpgf"kpvcev."uwej"cu"vjg"eqtrwu"qh"c"rgtocpgpv"hwpf0"" }$ 

 $Tguvtkevgf"hwpf"dcncpegu"ctg"tguvtkevgf"fwg"vq"ngicn"tguvtkevkqpu"htqo"etgfkvqtu."itcpvqtu."qt"ncyu"cpf"tgiwncvkqpu"qh"qvjgt"iqxgtpogpvu"qt"d{"ngicnn{"gphqtegcdng"gpcdnkpi"ngikuncvkqp"qt"eqpuvkvwvkqpcn"rtqxkukqpu0""}$ 

55"

#### $\underline{Pqvg"3"/"Uw\ o\ o\ ct\{"qh"Uk\ i\ pkhkecpv"Ceeqwpvkp\ i\ "Rqnkekgu"*Eqpv0+<"}$

#### $\label{eq:word_problem} W0'''' \underline{Pgyn\{"Cfqrvgf"Uvcvgogpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d\{"vjg" \ I \ CUD<" \ UUCvg \ O \ Gpvu"Kuuwgf"d \ UUCvg \ O \ UUcvg$

I

 $\label{eq:control_problem} Vjg"\ I\ qxgtp\ o\ gpvcn"\ Ceeqwpvkp\ i\ "Uvcpfctfu"\ Dqctf"\ jcu"\ kuuwgf"\ Uvcvg\ o\ gpv''\ Pq0"\ ;7."\ Rquvrqpg\ o\ gpv''\ qh"\ vjg''\ Ghhgevkxg''\ Fcvgu''\ qh''\ Egtvckp''\ Cwvj\ qtkvcvkxg''\ I\ wkfcpeg."\ ghhgevkxg''\ k\ o\ o\ g\ fkcvgn\{0"\ "Vjku''\ Uvcvg\ o\ gpv''\ gzvgp\ fu''\ vjg''\ ghhgevkxg''\ fcvgu''\ qh'''egtvckp''ceeqwpvkpi''cpf''hkpcpekcn''tgrqtvkpi''rtqxkukqpu''kp''Uvcvg\ o\ gpvu''cpf'''K\ o\ rng\ o\ gpvcvkqp'' \\ \ O\ \#\ T\ \$<''\ R5\ f\ \#\ r$ 

ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" PQVGU"VQ"VJG"HKPCPEKCN"UVCVGOGPVU"

#### Pqvg"3"/"Uwooct{"qh"Ukipkhkecpv"Ceeqwpvkpi"Rqnkekgu"\*Eqpv0+<"

 $\label{eq:Vjg} Vjg"\ I\ qxgtp\ o\ gpvcn"\ Ceeqwpvkpi"\ Uvcpfctfu"\ Dqctf"\ jcu"\ cnuq"\ kuuwgf"\ Uvcvg\ o\ gpv"\ Pq0"\ ;5."\ Tgrnceg\ o\ gpv"\ qh"\ Kpvgtdcpm"Qhhgtg\ f"Tcvgu0"Vjg"tg\ o\ qxcn"qh"NKDQT"cu"cp"crrtqrtkcvg"dgpej\ o\ ctm"kpvgtguv"tcvg"ku"ghhgevkxg"hqt"\ tgrqtvkpi"rgtkqfu"gpfkpi"chvgt"Fgeg\ o\ dgt"53."42430"\ I\ CUD"\ ;7"gzvgpfgf"vjg"fwg"fcvg"hqt"rctcitcrju"35"cpf"\ 36"*ngcug"\ o\ qfkhkecvkqpu+"vq"tgrqtvkpi"rgtkqfu"dgikppkpi"chvgt"Lwpg"37."42430""Cnn"qvjgt"tgswktg\ o\ gpvu"qh"vjg"\ Uvcvg\ o\ gpv"ctg"ghhgevkxg"hqt"tgrqtvkpi"rgtkqfu"dgikppkpi"chvgt"Lwpg"37."42420"Vjg"rtk\ o\ ct{"qdlgevkxg"qh"vjku"}\ Uvcvg\ o\ gpv"ku"\ vq"\ cfftguu"\ vjg"\ ceeqwpvkpi"\ cpf"\ hkpcpekcn"\ tgrqtvkpi"\ k\ o\ rnkecvkqpu"\ vjcv"\ tguwnv"\ htq\ o"\ vjg"\ tgrnceg\ o\ gpv"Pq0"\ ;5"\ o\ c{"jcxg"qp"kvu"hkpcpekcn"uvcvg\ o\ gpvu0"""}$ 

 $\label{thm:continuou} Vjg"\ I\ qxgtp\ o\ gpvcn"\ Ceeqwpvkp\ i\ "Uvcpfctfu"\ Dqctf"\ jcu"\ cnuq"\ kuuwg\ f\ "Uvcvg\ o\ gpv"\ Pq0"\ ;6."\ Rwdnke/Rtkxcvg\ cpf"\ Rwdnke/Rtkxcvg\ cpf"\ Rwdnke/Rwdnke"\ Rctvpgtujkru"\ cpf''\ Cxckncdknkv{''\ Rc{ogpv''\ Cttcpig\ o\ gpvu."\ ghhgevkxg''\ hqt''\ tgrqtvkpi''\ rgtkqfu''\ dgikppkpi"chvgt"Lwpg"37."42440"Vjg"rtk\ o\ ct{"qdlgevkxg"qh"vjku"Uvcvg\ o\ gpv"ku"vq"k\ o\ rtqxg"hkpcpekcn"tgrqtvkpi''\ d{"cfftguukpi''\ kuuwgu''\ tgncvgf''\ vq''\ rwdnke/rtkxcvg''\ cpf''\ rwdnke/rwdnke''\ rctvpgtujkr''\ cttcpig\ o\ gpvu''*RRRu+0''\ Vjg'''\ Uejqqn"Dqctf''jcu"pqv''{gv''fgvgt\ o\ kpgf''vjg''ghhgev''vjcv''vjg''cfqrvkqp"qh''\ I\ CUD''Uvcvg\ o\ gpv''\ Pq0''';6''\ o\ c{"jcxg"qp'''\ kvu''hkpcpekcn"uvcvg\ o\ gpvu0''''''''}$ 

Vjg" I qxgtp o gpvcn" Ceeqwpvkpi" Uvcpfctfu" Dqctf" j cu" cnuq" kuuwgf" Uvcvg o gpv" Pq0"; 8." Uwduetkrvkqp/Dcugf" Kphqt o cvkqp" Vgejpqnqi {"Cttcpig o gpvu.35

Pqvg"4"/"Uvgyctfujkr."Eqornkcpeg"cpf"Ceeqwpvcdknkv{"\*Eqpv0+<"

## Pqvg"6"/"Rtqrgtv{"Vczgu<"

 $Cnn"rtqrgtv\{"kp"vjg"Uvcvg"ku"encuukhkgf"cu"hqnnqyu"hqt"cf"xcnqtgo"vcz"rwtrqugu<"ndaysumuntu below the sumulation of th$ 

 $\label{lem:condition} Encuu" K"/" \ Cnn" \ vcpikdng" \ rgtuqpcn" \ rtqrgtv \{ \ "gornq \{ gf \ "gzenwukxgn \{ \ "krong \ proper \$ 

## $\underline{Pqvg"6"/"Rtqrgtv\{"Vczgu"*Eqpv0+<"}$

 $\label{thm:continuous} Vjg"vczgu"qp"tgcn"rtqrgtv{"cpf"vjg"kpvgtguv"cpf"qvjgt"ejctigu"wrqp"uwej"vczgu"cvvcej"cu"cp"gphqtegcdng"nkgp"qp"vjg"hktuv"fc{"qh"Lwn{"gcej"{gct0"Vjgtg"ku"pq"nkgp"fgpqokpcvgf"cu"uwej"qp"rgtuqpcn"rtqrgtv{0"Jqygxgt."}}$ 

 $\underline{Pqvg"7"/"Gzeguu"Ngx\{"*Eqpv0+<""}$ 

#### Pqvg"8"/"Ecrkvcn"Cuugvu<"

Ecrkvcn"cuugv"dcncpegu"cpf"cevkxkv{"hqt"vjg"{gct"gpfgf"Lwpg"52."4242."ctg"cu"hqnnqyu<"

Dempeg
Lwpg"52."423;
Cfflwlqpu
Flurquenu
Lwpg"52."4242

64"

#### Pqvg": "ó"Ngcugu"\*Eqpv0+<"""

 $\label{thm:cont} Vjg"hqnnqykpi"ku"c"uwooct{"qh"vjg"hwvwtg"okpkowo"tgswktgf"rc{ogpvu"d{"{gct"wpfgt"vjg"ngcug"rwtejcug"citggogpv"vqigvjgt"ykvj"vjg"rtgugpv"xcnwg"qh"vjg"pgv"okpkowo"rc{ogpvu"cu"qh"Lwpg"52."4242"hqt"vjg"Uejqqn"Dqctføu"ecrkvcn"ngcugu<"}$ 

[gct"Gpfkpi"Lwpg"52.	Rtkpekrcn
4243	&""""6;2.983
	&""""6;2.983
	774

 $\label{eq:vjg} Vjg"Uejqqn"Dqctf"jcu"gpvgtgf"kpvq"c"ecrkvcn"ngcug/rwtejcug"citggogpv"vq"rwtejcug"encuutqoo"vgejpqnqi{;" 2 . 9 8 fgxkegu" htqo"Crrng." Kpe0" Vjg" gswkrogpv" ku" ngcugf" fktgevn{" htqo"Crrng." Kpe0" hqt" c" rgtkqf" qh" 5" {gctu" dgikppkpi"Hgdtwct{"37."423;0"Cv"vjg"gpf"qh"vjg"eqpvtcev"rgtkqf."vjg"Uejqqn"Dqctf" ykm"jcxg"qypgtujkr"qh" vjg" gswkrogpv0""D{"eqpvtcev." vjg" Uejqqn"Dqctf" jcu" vjg" qrvkqp" qh" fkueqpvkpwkpi" vjg" ngcug" rwtejcug" cpf" tgvwtpkpi"vjg"gswkrogpv"cv"vjg"gpf"qh"cp{"hkuecn" {gct."kh"hwpfkpi"hqt"vjg"ngcug"rc{ogpvu"hqt"vjg"pgzv"hkuecn" {gct"ku"pqv"cxckncdng0"}}$ 

 $\label{eq:composition} Vjg"hqmq\,y\,kp\,i"ku"c"uw\,o\,oct\{"qh"v\,j\,g"hwvwtg"\,o\,kpk\,o\,w\,o"tgswktg\,f"rc\{\,o\,gpvu"d\{"\{gct"wp\,fgt"v\,j\,g"ngcug"rwte\,j\,cug"\,citgg\,o\,gpv"\,vq\,i\,gv\,j\,gt"\,y\,kv\,j"\,v\,j\,g"\,rtgugpv"\,x\,cnwg"\,qh"\,v\,j\,g"\,pgv"\,o\,kpk\,o\,w\,o\,"\,rc\{\,o\,gpvu"\,cu"\,qh"\,Lwpg"\,52."\,4242"\,hqt"\,v\,j\,g"\,Ue\,j\,qqn"Dqctf\,gu"ec\,rkvcn"ngcugu<""$ 

 $\label{thm:continuous} Vjg"Uejqqn"Dqctf"jcu"gpvgtgf"kpvq"c"ecrkvcn"ngcug/rwtejcug"citggogpv"vq"rwtejcug"encuutqqo"oqpkvqtu0""Vjg"ngcug"hwpfu"jcxg"dggp"rtqxkfgf"d{"Wpkvgf"Dcpm"hqt"c"rgtkqf"qh"5"{gctu"dgikppkpi"Oc{"4;."423;0"}}\\ Hwpfu"yknn"dg"wugf"vq"rwtejcug"gswkrogpv"hqt"encuutqqou0"Cv"vjg"gpf"qh"vjg"eqpvtcev"rgtkqf."vjg"Uejqqn"Dqctf"yknn"jcxg"qypgtujkr"qh"vjg"gswkrogpv0"D{"eqpvtcev."vjg"Uejqqn"Dqctf"jcu"vjg"qrvkqp"qh"fkueqpvkpwkpi"vjg"ngcug"rwtejcug"cpf"tgvwtpkpi"vjg"gswkrogpv"cv"vjg"gpf"qh"cp{"hkuecn"{gct."kh"hwpfkpi"hqt"vjg"ngcug"rc{ogpvu"hqt"vjg"pgzv"hkuecn"{gct"ku"pqv"cxckncdng0"}}\\$ 

#### Pqvg";"/"Gornq{gg"Tgvktgogpv"U{uvgo"\*Eqpv0+<"

 $\label{thm:convex} Vjg"pqtocn"hqto"qh"dgpghkv"ku"c"ukping"nkhg"cppwkv{"rckf"oqpvjn{."kp"cp"coqwpv"gswcn"vq"4' "qh"vjg"hkpcn" cxgtcig"ucnct{"vkogu"{gctu"qh"etgfkvgf"ugtxkeg0"Qvjgt"hqtou"qh"dgpghkvu"oc{"dg"gngevgf"uwdlgev"vq"cevwctkcn" tgfwevkqp<"Ecuj"Tghwpf"Cppwkv{."72' "qt"322' "Eqpvkpigpv"Lqkpv"cpf"Uwtxkxqt"Cppwkvkgu."cpf"vgp"{gct"}$ 

#### Pqvg";"/"Gornq{gg"Tgvktgogpv"U{uvgo"\*Eqpv0+<"

 $\label{thm:continuous} Hqt"vjg" \{gct"gpfgf"Lwpg"52."4242."vjg"Uejqqn"Dqctf"tgeqipk|gf"rgpukqp"gzrgpug"qh"&36.:99.639."cpf"hqt"uwrrqtv"rtqxkfgf"d{"vjg"Uvcvg."tgxgpwg"qh"&35.88;.;660"Cv"Lwpg"52."4242."vjg"Uejqqn"Dqctf"tgrqtvgf"fghgttgf"qwvhnqyu"cpf"fghgttgf"kphnqyu"qh"tguqwtegu"tgncvgf"vq"rgpukqpu"htqo"vjg"hqnnqykpi"uqwtegu<"$ 

	Fghgttgf"Qwhqyu qh"Tguqwtegu	Fghgttgf"Kphnqyu qh"Tguqwtegu
Pgv"fkhhgtgpeg"dgvyggp"rtqlgevgf"cpf"cevwcn"gctpkpiu		
qp"rgpukqp"rncp"kpxguvogpvu	&""""/	&""""427.:2:
Fkhgtgpegu"dgvyggp"gzrgevgf"cpf"cevwcn"gzrgtkgpeg	""""59.:33	""""47:.865
Ejcpigu"kp"rtqrqtvkqp"cpf"fkthgtgpegu"dgvyggp"Uejqqn		
Dqctf"eqpvtkdwvkqpu"cpf"rtqrqtvkqpcvg"ujctg"qh"eqpvtkdwvkqpu	"""""::::.67;	""""5:9.:6;
Ejcpigu"kp"cuuworvkqpu	""""385.5:;	"""""/
Fkuvtkev"eqpvtkdwvkqpu"uwdugswgpv"vq"vjg"ogcuwtgogpv"fcvg	""""3.452.2:6	""""""/
Vqvcn	&""""4.53;.965	&""""::74.522

 $\label{lem:continuous} Uejqqn"Dqctf"eqpvtkdwvkqpu"uwdugswgpv"vq"vjg"ogcuwtgogpv"fcvg"yknn"dg"tgeqipk|gf"cu"c"tgfwevkqp"qh"vjg"pgv"rgpukqp"nkcdknkv{"kp"vjg"{gct"gpfkpi"Lwpg"52."42420"Qvjgt"coqwpvu"tgrqtvgf"cu"fghgttgf"qwvhnqyu"cpf"fghgttgf"kphnqyu"qh"tguqwtegu"tgncvgf"vq"rgpukqpu"yknn"dg"tgeqipk|gf"kp"rgpukqp"gzrgpug"cu"hqnnqyu"$ 

#### $\underline{Pqvg}$ ";"/" $\underline{G}$ o $\underline{rnq}$ { $\underline{gg}$ " $\underline{Tgvktg}$ o $\underline{gpv}$ " $\underline{U}$ { $\underline{uvg}$ o "\* $\underline{Eqpv0}$ +<"

#### Cevwctkcn"Cuuw o rvkqpu<"

"
"
Tevwetken Cuuw o rykqp

 $\label{thm:converge} Hqt"VTU."vjg"cevwctkcn"cuuw\ o\ rvkqpu"wug\ f"kp"vjg"Lwn{"3."423:"xcnwcvkqp."ykvj"wr\ fcvg"rtqeg\ fwtgu"wug\ f"vq"tqnn"\ hqtyctf"vjg"vqvcn"rgpukqp"nkcdknkv{"vq"Lwpg"52."423;."ygtg"dcug\ f"qp"vjg"tguwnvu"qh"cp"cevwctkcn"gzrgtkgpeg"uvwf{"hqt"vjg"rgtkqf"Lwn{"3."4232."vq"Lwpg"52."42370"Vjgug"cuuw\ o\ rvkqpu"ctg"cu"hqnnqyu<"}$ 

**Kphncvkqp"ó"**502 ' "

Ucnct{" kpetgcugu" ó" Hqt" vgcejgt" ogodgtu." ucnct{" kpetgcugu" ctg" dcugf" qp" ogodgt" gzrgtkgpeg"
 fgrgpfgpv" qp" cig" cpf" igpfgt." tcpikpi" htqo" 5022/8022 ' 0" " Hqt" pqp/vgcejgt" ogodgtu." ucnct{"
 kpetgcugu"ctg"dcugf"qp" ogodgt"gzrgtkgpeg."fgrgpfgpv"qp"cig"cpf"igpfgt."tcpikpi"htqo"5022 ' /
 8072 ' 0"

**Kpxguv o gpv"tcvg"qh"tgvwtp"ó**"907 '."pgv"qh"rgpukqp"rncp"kpxguv o gpv"gzrgpug."kpenwfkpi "kphncvkqp0"

Oqtvcnkv{" 6" Cevkxg<" TR/4222." Pqp/Cppwkvcpv" vcdng." rtqlgevgf" ykvj" Uecng" CC" qp" c" hwnn{" i gpgtcvkqpcn" dcuku0" Tgvktgf<" j gcnvj {" o cngu" 6" ;9 ' " qh" TR/4222" J gcnvj {" Cppwkvcpv" vcdng." rtqlgevgf" ykvj" Uecng" CC" qp" c" hwnn{" i gpgtcvkqpcn" dcuku." j gcnvj {" hg o cngu" 6" ;6 ' " qh" TR/4222" J gcnvj {" Cppwkvcpv" vcdng." rtqlgevgf" ykvj "Uecng" CC" qp" c" hwnn {" i gpgtcvkqpcn" dcuku=" fkucdngf" o cngu" 6" ;8" ' "qh" TR/4222" F q\_

#### Pqvg";"/"Gornq{gg"Tgvktgogpv"U{uvgo"\*Eqpv0+<"

#### Fkueqwpv"Tcvg<"

 $\label{thm:continuous} Vjg"fkueqwpv"tcvg"wugf"vq"ogcuwtg"vjg"vqvcn"rgpukqp"nkcdknkv{"ycu"907'0"Vjg"rtqlgevkqpu"qh"ecuj"hnqyu"wugf"vq"fgvgtokpg"vjg"fkueqwpv"tcvgu"cuuwogf"vjcv"gornq{gt"eqpvtkdwvkqpu"yknn"eqpvkpwg"vq"hqnnqy"vjg"ewttgpv"hwpfkpi"rqnkekgu0"Dcugf"qp"vjqug"cuuworvkqpu."vjg"hkfwekct{"pgv"rqukvkqp"qh"vjg"VTU"Rncp"ycu"rtqlgevgf"vq"dg"cxckncdng"vq"ocmg"cnn"rtqlgevgf"hwvwtg"dgpghkv"rc{ogpvu"qh"vjg"ewttgpv"rncp"ogodgtu0"Vjgtghqtg."vjg"nqpi/vgto"gzrgevgf"tcvgu"qh"tgvwtp"qp"rgpukqp"rncp"kpxguvogpvu"ygtg"crrnkgf"vq"cnn"rgtkqfu"qh"rtqlgevgf"dgpghkv"rc{ogpvu"vq"fgvgtokpg"vjg"vqvcn"rgpukqp"nkcdknkv{0"}$ 

 $\label{thm:constraint} Vjg"hqnnqykpi"vcdng"rtgugpvu"vjg"Uejqqn"Dqctføu"rtqrqtvkqpcvg"ujctg"qh"kvu"pgv"rgpukqp"nkcdknkv{"ecnewncvgf" wukpi"vjg"fkueqwpv"tcvg"qh"907' "cpf"vjg"korcev"qh"wukpi"c"fkueqwpv"tcvg"vjcv"ku"3' "jkijgt"qt"nqygt"vjcp"vjg" ewttgpv"tcvg0"$ 

#### $Rc\{cdngu"vq"vjg"rgpukqp"rncp<"$

 $Cv" Lwpg" 52." 4242." vjg" Uejqqn" Dqctf" tgrqtvgf" c" nkcdknkv {" qh" & 3.588.678" hqt" kvu" wprckf" ngicnn {" tgswktgf" eqpvtkdwvkqpu" vq" vjg" rgpukqp" rncp0" Vjg" nkcdknkv {" ku" kpenwfgf" kp" vjg" dcncpeg" qh" ucnctkgu" raqn" D$ 

#### Pqvg";"/"Gornq{gg"Tgvktgogpv"U{uvgo"\*Eqpv0+<"

 $Ghhgevkxg" Lwn \{"3." 4227." vjg" Vgcejgtu\emptyset" Fghkpgf" Eqpvtkdwvkqp" Rncp" ycu" enqugf" vq" pgy" ogodgtujkr0" Cnn" gornq \{ggu" jktgf" chvgt" vjcv" fcvg" dgecog" ogodgtu" qh" vjg" Vgcejgtu\emptyset" Fghkpgf" Dgpghkv" Tgvktgogpv" U \{uvgo" yjkej" ycu" tgqrgpgf" hqt" rctvkekrcvkqp" qp" Lwn \{"3." 42270" Gzkuvkpi" ogodgtu" qh" vjg" Vgcejgtu\emptyset" Fghkpgf" Eqpvtkdwvkqp" Rncp" ygtg" ikxgp" vjg" qrvkqp" vq" vtcpuhgt" ogodgtujkr" vq" vjg" Vgcejgtu\emptyset" Fghkpgf" Dgpghkv" Tgvktgogpv" U \{uvgo" fwtkpi" vjg" 422:/2; "hkuecn" \{gct0" Vq"gctp" hwn" dgpghkvu" cv" tgvktgogpv." jqygxgt." ogodgtu" gngevkpi" vq" vtcpuhgt" ctg" tgswktgf" vq" eqpvtkdwvg" vjg" 307' "fkhhgtgpeg" dgvyggp" vjg" vyq" rncpu\emptyset" gornq \{gg" eqpvtkdwvkqp" tcvgu0" }$ 

 $C"wpkswg"hgcvwtg"qh"vjg"Vgcejgtu)"Fghkpgf"Eqpvtkdwvkqp"Rncp"ku"vjcv"gcej"ogodgt"ejqqugu"vjg"kpxguvogpv"qrvkqpu"cpf"oc{"ocmg"ejcpigu"cv"cp{"vkog0"}}$ 

E g %

## $\underline{Pqvg'';}''/"Go\ rnq\{gg''Tgvktg\ o\ gpv''U\{uvg\ o\ ''*Eqpv\emptyset+<''\}$

Hqt o gt"TGUC"Hkuecn"Cigpv<"			
$\label{eq:conditional} \begin{tabular}{ll} Kp" 4239." $Y0" $Xc0" $Eqfg" $E3:/4/48" $ycu" $cogpfgf" $cpf" $tgwnvkocvg"cdqnkujogpv"cpf" $fkuuqnwvkqp"qh"cnn"tgikqpcn"gfwLwn{"3."423:0"} \end{tabular}$			
X _	P/g a	0	cd E

" nÅ wnvk q

 $X \quad \text{''} \, dhO \qquad \# \qquad dhO$ 

#### $\underline{Pqvg"32"/"Rquv/G\ o\ rnq\{\ o\ gpv"Dgpghkvu"Qv\ j\ gt"V\ j\ cp"Rgpukqp"*Eqpv\emptyset+<"}$

#### Dgpghkvu"rtqxkfgf<"""

 $Wrqp"tgvktg\ o\ gpv."vjg"rwdnke"g\ o\ rnq\{ggu"\ y\ j\ q"gngevg\ f"vq"rctvkekrcvg"kp"vjg"RGKC"kpuwtcpeg"rncp"ctg"gnkikdng"vq"etg\ fkv"wpwug\ f"ukem"qt"cppwcn"ngcxg"vq\ y\ ctfu"kpuwtcpeg"eqxgtcig."ceeqt\ fkpi"vq"vjg"hqnnq\ y\ kpi"hqt o\ wncu<""$ 

 $Tgvktgf"gornq\{ggu"yjq"gngevgf"vq"rctvkekrcvg"kp"vjg"RGKC"kpuwtc$ 

#### Pqvg"32"/"Rquv/G o rnq{ o gpv"Dgpghkvu"Qvjgt"Vjcp"Rgpukqp"\*Eqpv0+<"

 $\label{thm:continuous} Vjg"Uvcvg"ku"c"pqpg\ o\ rnq\{gt"eqpvtkdwvkpi"gpvkv\{"vjcv"rtqxkfgu"hwpfkpi"vjtqwij"Ugpcvg"Dknn"63;."ghhgevkxg"Lwn\{"3."4234"cpf"c\ o\ gpfgf"d\{"Yguv"Xktikpkc"Eqfg"\grave{E}33/43/;80"Hqt"hkuecn"\{gctu"dgikppkpi"qp"cpf"chvgt"Lwn\{"3."4238."vjku"Ugpcvg"Dknn"cpf"eqttgurqpfkpi"Uvcvg"Eqfg"ugevkqp"tgswktgu"vjcv"cp"cppwcn"coqwpv"qh"&52"oknnkqp"htqo"vjg"Uvcvg"ujcnn"dg"fgfkecvgf"hqt"rc{ogpv"qh"vjg"wphwpfgf"nkcdknkv{"qh"vjg"TJDV"hwpf0"Vjg"&52"oknnkqp"cppwcn"eqpvtkdwvkqp"ku"vq"eqpvkpwg"vjtqwij"Lwn{"3."4259."qt"wpvkn"vjg"wphwpfgf"nkcdknkv{"jcu"dggp"gnkokpcvgf."yjkejgxgt"eqogu"hktuv0""}$ 

 $\label{thm:continuous} Vjg"Uvcvg"ku"c"pqpg\ o\ rnq\{gt"eqpvtkdwvkp\ i\ "gpvkv\{"vjcv"rtqxkfgu"hwpfkp\ i\ "vjtqw\ i\ j\ Yguv"Xkt\ ikpkc"Uvcvg"Eqfg"\ E33D/4/540"Vjg"Hkpcpekcn"Uvcdknkv\{"Hwpf"ku"c"rncp"vq"vtcpuhgt"cp"cppwcn"c\ o\ qwpv"qh"&7"Oknnkqp"vq"vjg"T\ J\ DV"\ htq\ o\ "urgekcn"\ tgxgpwg"hwpfu"\ vq"\ dg"\ wugf"\ vq"\ nq\ ygt"\ tgvktgg"\ rtg\ o\ kw\ o\ u."\ vq"\ jgnr"\ tgfweg"\ dgpghkv"\ ewvu."\ vq"\ jgnr"\ tgfweg"\ tgvktgg"\ vtcpuhgttg\ f"\ rwtuwcpv"\ vq"\ vj\ ku"\ Eqfg"\ uj\ cm"\ dg"vtcpuhgttg\ f"\ rwtuwcpv"\ vq"\ vj\ ku"\ Eqfg"\ uj\ cm"\ dg"vtcpuhgttg\ f"\ cppwcnn\{"kpvq"vj\ g"T\ J\ DV"vj\ tqw\ i\ j"Lwpg"52."42420"""$ 

 $QRGD"\ Nkcdknkvkgu."\ QRGD"\ Gzrgpug."\ cp\ f''\ Fghgttg\ f''\ Qwvhnq\ yu''\ qh''\ Tguqwtegu''\ Cp\ f''\ Fghgttg\ f''\ Kphnq\ yu''\ qh''\ Tguqwtegu''Tgncvg\ f''vq''QRGD'''$ 

Cv" Lwpg" 52." 4242." vjg" Uejqqn" Dqctf" tgrqtvgf" c" nkcdknkv{" hqt" kvu" rtqrqtvkqpcvg" ujctg" qh" vjg" pgv" QRGD" nkcdknkv{" vjcv" tghngevgf" c" tgfwevkqp" hqt" Uvcvg" QRGD" uwrrqtv" rtqxkfgf" vq" vjg" Uejqqn" Dqctf0" Vjg" coqwpv" tgeqipk|gf" d{" vjg" Uejqqn" Dqctf" cu" kvu" rtqrqtvkqpcvg" ujctg" qh" vjg" pgv" QRGD" nkcdknkv{." vjg" tgncvgf" Uvcvg" uwrrqtv."cpf" vjg" vqvcn" rqtvkqp" qh" vjg" pgv" QRGD" nkcdknkv{" vjcv" y cu" cuuqekcvgf" ykvj" vjg" Uejqqn" Dqctf" ygtg" cu"

#### $\underline{Pqvg"32"/"Rquv/G\ o\ rnq\{\ o\ gpv"Dgpghkvu"Qv\ j\ gt"V\ j\ cp"Rgpukqp"*Eqpv0+<"}$

 $\label{lem:continuous} Hqt"vjg" \{gct"gpfgf"Lwpg"52."423;."vjg"Uejqqn"Dqctf"tgeqipk|gf"QRGD"gzrgpug"qh"\&4.6;2.459"cpf"hqt"uwrrqtv"rtqxkfgf"d\{"vjg"Uvcvg."tgxgpwg"qh"\&;58.9:90"Cv"Lwpg"52."4242."vjg"Uejqqn"Dqctf"tgrqtvgf"fghgttgf"qwvhnqyu"qh"tguqwtegu"cpf"fghgttgf"kphnqyu"qh"tguqwtegu"tgncvgf$ 

 $\underline{Pqvg"32"/"Rquv/G\ o\ rnq\{\ o\ gpv"Dgpghkvu"Qv\ j\ gt"V\ j\ cp"Rgpukqp"*Eqpv\emptyset+<"}$ 

#### Pqvg"32"/"Rquv/G o rnq{ o gpv"Dgpghkvu"Qvjgt"Vjcp"Rgpukqp"\*Eqpv0+<"

#### Kpxguv o gpv"Cuugv"Cmqecvkqp<""

 $\label{eq:continuous} Vjg"nqpi/vgto"gzrgevgf"tcvg"qh"tgvwtp"qp"QRGD"rncp"kpxguvogpvu"ycu"fgvgtokpgf"wukpi"c"dwknfkpi/dnqem"ogvjqf"kp"yjkej"dguv/guvkocvg"tcpigu"qh"gzrgevgf"hwvwtg"tgcn"tcvgu"qh"tgvwtp"*gzrgevgf"tgvwtpu."pgv"qh"QRGD"rncp"kpxguvogpv"gzrgpug"cpf"kphncvkqp+"ctg"fgxgnqrgf"hqt"gcej"oclqt"cuugv"encuu0"Vjgug"tcpigu"ctg"eqodkpgf"vq"rtqfweg"vjg"nqpi/vgto"gzrgevgf"tcvg"qh"tgvwtp"d{"ygkijvkpi"vjg"gzrgevgf"hwvwtg"tgcn"tcvgu"qh"tgvwtp"d{"ygkijvkpi"qu"qh"tqvgyqqu"qh"tgvwtp"d{"ygkijvkpi"qu"qh"qu"q$ 

c"

#### Pqvg"32"/"Rquv/G o rnq{ o gpv"Dgpghkvu"Qvjgt"Vjcp"Rgpukqp"\*Eqpv0+<"

 $C"ukping" fkueqwpv" tcvg" qh" 9037 '"y cu"wug f"vq" o gcuwtg"vjg"vqvcn" QRGD"nkcdknkv \{0"Vjku"ukping" fkueqwpv" tcvg" y cu"dcug f"qp"vjg"gzrgevg f"tcvg"qh"tgvwtp"qp"QRGD"rncp"kpxguv o gpvu"qh"9037 '"cpf"c"vcz/gzg o rv" o wpkekrcn" dqpf"tcvg"dcug f"qp"cp"kpfgz"qh"42/{gct" i gpgtcn"qdnk i cvkqp"dqpfu" ykvj"cp"cxgtcig"CC"etgfkv"tcvkpi"cu"qh" vjg" o gcuwtg o gpv" fcvg"vq"vjg"gzvgpv"dgpghkvu"ctg"ghhgevkxgn {"hkpcpeg f"qp"c"rc{/cu/{qw/iq"dcuku0"Vjg"nqpi/vgt o" o wpkekrcn"dqpf"tcvg"wug f"vq" fgxgnqr"vjg"ukping" fkueqwpv"tcvg" y cu"5084 '"cu"qh"vjg"dgikppkpi"qh"vjg" {gct"cpf"5035 '"cu"qh"vjg"gpf"qh"vjg" {gct0"Vjg"rtqlgevkqp"qh"ecuj"hnqyu"wug f"vq"fgygt o kpg"vjku"ukping"fkueqwpv"tcvg"cuuw o gf"vjcv"g o rnq{gt"eqpvtkdwvkqpu"ykm"dg" o cfg"kp"ceeqtfcpeg"ykvj"vjg"rtghwpfkpi"cpf"kpxguv o gpv"rqnkekgu0"Hwvwtg"rtg/hwpfkpi"cuuw o rvkqpu"kpenwfg"c"&52"o knnkqp"cppwcn"eqpvtkdwvkqp"htqo"vjg"Uvcvg"vjtqwij"42590"Dcug f"qp"vjqug"cuuw o rvkqpu."cpf"vjcv"vjg"Rncp"ku"gzrgevg f"vq"dg"hwnn{"hwpfgf"d{"hkuecn"{gct"gpfgf"Lwpg"52."4255."vjg"QRGD"rncpøu"hkfwekct{"pgv"rqukvkq}}}$ 

### Pqvg"32"/"Rquv/Gornq{ogpv"Dgpghkvu"Qvjgt"Vjcp"Rgpukqp"\*Eqpv0+<"

#### Qrv/Qwv"G o rnq{gt"Dcncpeg"Tgcnnqecvkqp"

 $Egtvckp"g\ o\ rnq\{gtu"vj\ cv"\ o\ ggv"vj\ g"rncp\emptysetu"qrv/qwv"etkvgtkc"ctg"pq"nqp\ i\ gt"tgswktgf"vq"\ o\ cmg"eqpvtkdwvkqpu"vq"vj\ g"rncp0"Vj\ gug"qrv/qwv"g\ o\ rnq\{gtu"j\ cxg"pq"eqpvkpwkpi"kpxqnxg\ o\ gpv"ykvj"vj\ g"rncp0"Ceeqtfkpin{."vj\ g"c\ o\ qwpvu"rtgxkqwun{"cnnqecvgf"vq"uwej"g\ o\ rnq{gtu"hqt"vjg"pgv"QRGD"nkcdknkv{"cpf"tgncvgf"fghgttgf"kphnqyu"cpf"qwvhnqyu"ctg"tgcnnqecvgf"vq"vjg"tg\ o\ ckpkpi"g\ o\ rnq{gtu"rctvkekrcvkpi"kp"vjg"equv"ujctkpi"rncp0"Vjg"rncp"tgcnnqecvgu"vjgug"dcncpegu"vjg"tg\ o\ ckpkpi"cevkxg"g\ o\ rnq{gtu"dcugf"qp"vjgkt"rtqrqtvkqpcvg"ujctg"qh"eqpvtkdwvkqpu"o\ cfg"kp"vjg"rgtkqf"qh"tgcnnqecvkqp0"}$ 

#### $Hqt\ o\ gt"TGUC"H \\ kuecn"C\ i\ gpv"$

 $\label{eq:continuous} \begin{tabular}{ll} Kp" 4239." Y 0" Xc0" Eqfg" E3: $/4/48"$ y cu" c o gpfgf" cpf" tggpcevgf" d{" vjg" Uvcvg" ng i kuncvwtg." ngc fkp i " vq" vjg" wnvk o cvg" cdqnkuj o gpv" cpf" fkuuqnwvkqp"qh" cm" tg i kqpcn" g fwecvkqp" ugtxkeg" c i gpekgu" *TGUCu+" d{"pq" ncvgt" vjcp" Lwn{"3."423:0"} \end{tabular}$ 

 $\label{thm:contour} Vjg"Uejqqn"Dqctf"ku"c"hqtocn"hkuecn"cigpv"qh"TGUC"40"Hqt"hkpcpekcn"uvcvgogpv"rwtrqugu"wr"vjtqwij"vjg"hkuecn" {gct"gpfgf"Lwpg"52."423:."vjg"coqwpvu"rtgugpvgf"qp"vjg"cwfkvgf"ERTD"cnnqecvkqp"uejgfwngu"hqt"vjg"hkuecn"cigpv"eqwpv{"dqctf"qh"gfwecvkqp"ygtg"urnkv"rtqrqtvkqpcvgn{"dgvyggp"vjg"Uejqqn"Dqctf"cpf"vjg"TGUC"d{"guvkocvkpi"vjg"TGUC"coqwpv"qh"pgv"QRGD"nkcdknkv{."QRGD"gzrgpug."fghgttgf"kphnqyu."cpf"fghgttgf"qwvhnqyu0"Vjg"guvkocvg"ycu"dcugf"qp"vjg"dtgcmfqyp"qh"rc{tqnn"fcvc"cxckncdng"vq"vjg"Uejqqn"Dqctf0"Urgekhkecnn{."gcej"gpvkv{\00ex0u"eqpvtkdwvkqpu"hqt"vjg"hkuecn"{gct"rgtvckpkpi"vq"vjg"ogcuwtgogpv"fcvg"vq"vjg"rncp"ygtg"wugf"vq"guvkocvg"vjgkt"rtqrqtvkqpcvg"ujctg"qh"vjg"pgv"QRGD"nkcdknkv{."QRGD"gzrgpug."fghgttgf"kphnqyu."cpf"fghgttgf"qwvhnqyu0"$ 

## $\underline{Pqvg"34"/"Rgp\,f\,kp\,i\,"N\,kv\,k\,i\,cv\,kqp\!<"}$

 $\label{thm:continuous} Vjg"Dqctf"ku"kpxqnxgf"kp"c"pwodgt"qh"ngicn"rtqeggfkpiu"cpf"enckou."kpxqnxkpi"uvwfgpvu."gornq\{ggu"cpf"uvwfgpvu."gornq[ggu"cpf"uvwfgpvu."gornq[ggu"cpf]$ 

#### Pqvg"36"/"Eq o o kv o gpvu."Eqpvkp i gpekgu"cpf"Uwdug swgpv"Gxgpvu<"

Vjg"Uejqqn"Dqctf"jcf"	gpew o dtcpegu"vqvcnkp i	%32.54:.276"cu"qh"Lwpg"52	."4242"kp"v j g"hqnnq y kp i "hwp f u<"

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 $Cu"qh"Lwpg"52."4242"vjg"hqnnqykpi"coqwpvu"yknn"dg"wugf"hqt"eqpuvtwevkqp"cpf"qvjgt"ecrkvcn"kortqxgogpvu."yjkej"ctg"kpenwfgf"kp"vjg"tguvtkevgf"hwpf"dcncpeg"tghngevgf"kp"vjg"ceeqorcp{kpi"hkpcpekcn"uvcvgogpvu<"}$ 

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#### $\underline{Pqvg"36"/"Eq\ o\ o\ kv\ o\ gpvu."Eqpvkp\ i\ gpekgu"cp\ f"Uwdug\ s\ wgpv"Gxgpvu"*Eqpv0+<"}$

Vjg" Uejqqn" Dqctf" qypu" xctkqwu" dwknfkpiu" yjkej" ctg" mpqyp" vq" eqpvckp" cudguvqu" cpflqt" qyjgt" gpxktqp o gpvcn" kuuwgu0" Vjg" Uejqqn" Dqctf" ku" pqv" tgswktgf" d{" hgfgtcn." uvcvg" qt" nqecn" ncy" vq" tg o qxg" vjg" cudguvqu"htq o "kvu" dwknfkpiu0" Vjg" Uejqqn" Dqctf" ku"tgswktgf" wpfgt" hgfgtcn" gpxktqp o gpvcn" jgcnvj" cpf" uchgv {" tgiwncvkqpu"vq" o cpcig" vjg" rtgugpeg" qh" cudguvqu" cpf" qvjgt" gpxktqp o gpvcn" kuuwgu" kp" kvu" dwknfkpiu" kp" c" uchg" eqpfkvkqp0" Vjg" Uejqqn" Dqctf" cfftguugu" kvu" tgurqpukdknkv {" vq" o cpcig" vjg" rtgugpeg" qh" cudguvqu" cpf" qvjgt" gpxktqp o gpvcn" kuuwgu" kp" kvu" dwknfkpiu" app" c" ecug" d{" ecug" dcuku0" Ukipkhkecpv" rtqdng o u"qh" fcpigtqwu" cudguvqu" eqpfkvkqpu" ctg" cdcvgf" cu" vjg" eqpfkvkqpu" dgeq o g"mpqyp0" Vjg" Uejqqn" Dqctf" cnuq" cfftguugu" vjg" rtgugpeg" qh" cudguvqu" cudguvqu" cudguvqu" cudguvqu" ctg" wpfgtvcmgp" cpf" vjtqwij" cudguvqu" qrgtcvkqp" cpf" o ckpvgpcpeg" rtqitcou" fktgevgf" cv" eqpvckpkpi." o cpcikpi." qt" qrgtcvkpi" ykvj" vjg" cudguvqu" kp" c" uchg" eqpfkvkqp0"

#### Pqvg"37"/"Kpvgthwpf"Dcncpegu"cpf"Vtcpuhgtu<

Vjg"eq o rqukvkqp"qh"kpvgthwpf"dcncpegu"cu"qh"Lwpg"52."4242"ku"cu"hqnnqyu<"

#### Pqvg"38"/"Oclqt"Uqwtegu"qh"Tgxgpwg<"

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#### Pqvg"39"6"EQXKF/3; "Rcpfgoke"\*Eqpv0+<"

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# ECDGNN"EQWPV ["DQCTF"QH"GFWECVKQP UE J GFWNG"QH"V J G"FKUVTKEV)U"RGPUKQP"EQPVTKDWVKQPU HQT"V J G"HKUECN" [ GCT"GPFGF"LWPG"52."4242

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# ECDGNN"EQWPV ["DQCTF"QH"GFWECVKQPUEJGFWNG"QH"VJG"FKUVTKEV)U"RTQRQTVKQPCVG"UJCTG"QH"VJG"PGV"QRGD"NKCDKNKV[HQT"VJG"HKUECN" [GCT"GPFGF"LWPG"52."4242

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Data prior to 2018 is unavailable			

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# ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP" PQVGU"VQ"V J G"TGS WKTGF"UWRRNGOGP VCT [ "KPHQTOCVKQP" HQT"V J G"HKUECN" [ GCT"GP FGF"LWPG"52."4242"

## C0" <u>Dwfigvu"cpf"Dwfigvct{"Ceeqwpvkpi<"</u>

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# ECDGNN"EQWPV ["DQCTF"QH"GFWECVKQP UVCVGOGPV"QH"TGXGPWGU."GZRGPFKVWTGU."CPF"EJCPIGU"KP"HWPF"DCNCPEGU"/ DWFIGV"CPF"CEVWCN"/"ECRKVCN"RTQLGEVU"HWPF HQT"VJG"HKUECN" [GCT"GPFGF"LWPG"52."4242

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# ECDGNN"EQWPV ["DQCTF"QH"GFWECV!(QP UE JGFWNG"QH"GZEGUU"NGX ["TGXGPWGU"CPF"GZRGPF!(VWTGU HQT"V JG"HKUECN" [GCT"GPFGF"LWPG"52,"4242

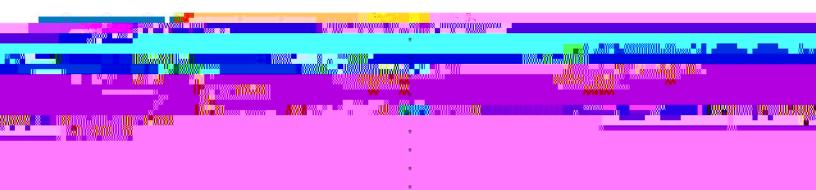
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## ECDGNN"EQWPV [ "DQCTF"QH"GFWECVKQP UEJGFWNG"QH"GZRGPFKVWTGU"QH"HGFGTCN"CYCTFU HQT"VJG"HKUECN" [ GCT"GPFGF"LWPG"52."4242

Hgfgtcn" I tcpvqtl Rcuu/Vjtqwij" I tcpvqtl <u>Rtqitco"Vkvng</u>	Hgfgtcn" EHFC <u>Pwodgt</u>	Rcuu/Vjtqwij Itcpvqt)u" <u>Pwodgt</u>	Gzrgpfkvwtgu" <u>Rckf</u>
W0U0"Fgrctvogpv"qh"Citkewnvwtg			
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# KPFGRGPFGPV"CWFKVQTU)"TGRQTV"QP"EQORNKCPEG"" HQT"GCEJ"OCLQT"RTQITCO"CPF"QP"KPVGTPCN"EQPVTQN"" QXGT"EQORNKCPEG"TGSWKTGF"D["VJG"WPKHQTO"IWKFCPEG"

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# Management's Responsibility

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## Auditors' Responsibility

Qwt" tgurqpukdknkv{" ku" vq" gzrtguu" cp" qrkpkqp" qp" eq o rnkcpeg" hqt" gcej " qh" vjg" Ecdgnn" Eqwpv{" Dqctf" qh" Gfwecvkqpøu" o clqt"hgfgtcn" rtqitc o u"dcugf"qp"qwt"cwfkv"qh"vjg"v{rgu"qh"eq o rnkcpeg"tgswktg o gpvu"tghgttgf" vq"cdqxg0" Yg"eqpfwevgf"qwt"cwfkv"qh"eq o rnkcpeg"kp"ceeqtfcpeg" ykvj "cwfkvkpi "uvcpfctfu" i gpgtcnn{"ceegrvgf" kp" vjg" Wpkvgf" Uvcvgu" qh" C o gtkec=" vjg" uvcpfctfu" crrnkecdng" vq" hkpcpekcn" cwfkvu" eqpvckpgf" kp" Government Auditing Standards. "kuuwgf"d{"vjg"Eq o rvtqnngt" I gpgtcn"qh"vjg"Wpkvgf"Uvcvgu="cpf"vjg"cwfkv"tgswktg o gpvu"qh" Vkvng" 4" W0U0" Code of Federal Regulations Rctv" 422." Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards \*Wpkhqto" I wkfcpeg+0" Vjqug" uvcpfctfu" cpf" vjg" Wpkvqto" I wkfcpegt tgswktg" vjcv" yg" rncp" cpf" rgthqto" vjg" cwfkv" vq" qdvckp" tgcuqpcdng" cuuwtcpeg" cdqwv" yjgvjgt" pqpeq o rnkcpeg" ykvj" vjg" v{rgu"qh" eq o rnkcpeg" tgswktg o gpvu" tghgttgf" vq" cdqxg" vjcv" eqwnf" jcxg" c"fktgev" cpf" o cvgtkcn" ghhgev" qp" c" o clqt" hgfgtcn" rtqitco " qeewttgf0" Cp" cwfkv" kpenwfgu" gzco kpkpi." qp" c" vguv" dcuku." gxkfgpeg" cdqwv" vjg" Ecdgnn" Eqwpv{"Dqctf"qh" Gfwecvkqpøu" eq o rnkcpeg" ykvj" vjqug" tgswktg o gpvu" cpf" rgthqto kpi"uwej "qvjgt" rtqegfwtgu"cu" yg"eqpukfgtgf"pgeguuct{"kp"vjg"ektew o uvcpegu0"

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# Opinion on Each Major Federal Program

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 $Tgrqtv"qp"\texttt{K}pvgtpcn"\textbf{E}qpvtqn"\textbf{Q}xgt"\textbf{E}q\ o\ rnkcpeg"$ 

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# $ECDGNN"EQWPV\ [\ "DQCTF"QH"GFWECVKQP" \\ UE\ J\ GFWNG"QH"RTKQT"CWFKV"HKPFKP\ I\ U"CPF"SWGUVKQPGF"EQUVU" \\ HQT"V\ J\ G"HKUECN"\ [\ GCT"GPFGF"LWPG"52."4242"$

Vjgtg"ygtg"pq"hkpfkpiu"kp"vjg"rtkqt"cwfkv0"